MINISTRY OF HEALTH
SCOTTISH HOME AND HEALTH DEPARTMENT

CENTRAL HEALTH SERVICES COUNCIL
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Surgery for the Newborn

Report of the Joint Sub-Committee of the Standing Medical Advisory Committees

LONDON
HER MAJESTY'S STATIONERY OFFICE
1968
FOUR SHILLINGS NET

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MEMBERS OF THE JOINT SUB-COMMITTEE ON SURGERY FOR THE NEWBORN

Appointed by the Standing Medical Advisory Committee

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Secretary

R. E. Clark, Esq.

FOREWORD

The Standing Medical Advisory Committee and the Scottish Standing Medical Advisory Committee accepted the report and recommended its publication but they recognise that it applies to ideal conditions which do not yet exist and contemplate that it will be implemented over a period as development of the services permits. They regard it as an expert examination of the subject and as a valuable stimulus to further thought and progress in the field of neonatal surgery.

R. E. Tunbridge

I. S. Smillie

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CHAPTER I. INTRODUCTION AND TERMS OF REFERENCE

1. At their meeting on 10th November 1964, the Standing Medical Advisory Committee for England and Wales considered a memorandum prepared by the Ministry of Health discussing recent advances in the treatment of spina bifida. The Committee decided that a sub-committee should be set up to make a further study of this subject; and after correspondence between the chairman of the Committee and the chairman of the Scottish Standing Medical Advisory Committee, it was decided that a joint sub-committee should be formed, with the following terms of reference:—

> 'To study developments in the surgical treatment of the newborn and to recommend what provision is required in the Hospital Service including rehabilitation and aftercare'.

The membership of the sub-committee is shown on page (i).

2. The secretary of the sub-committee was Mr. R. E. Clark and meetings have been attended by Dr. R. N. Chamberlain, Dr. C. N. Dennis and Miss M. C. Schurr of the Ministry of Health, and by Dr. I. S. Macdonald and Dr. M. E. Mitchell of the Scottish Home and Health Department.

3. We have held eight meetings, and have obtained a considerable volume of detailed information from many sources, including the Ministry of Health, the Scottish Home and Health Department, the General Register Office, and individuals with special interest in and knowledge of this subject. We are most grateful to them for their help.

4. We have interpreted our terms of reference fairly strictly. We have regarded ourselves as limited to consideration of congenital malformations which need and can be given surgical treatment or a surgical opinion in the first few weeks of life. We have excluded a good deal of routine infant surgery, including pyloric stenosis and some cardiac cases. In considering the provision to be made for rehabilitation and aftercare of congenitally malformed children we have taken no account of the services which are the responsibility of local health and welfare and education authorities. The progress which has been made in the surgical and medical treatment of babies with congenital malformations, which is discussed briefly in paragraphs 13 to 19 below, will rapidly increase the responsibilities of those authorities, and we recommend that separate studies of these problems should be put in hand by the appropriate Departments.

5. For some people, not all of them doctors, our terms of reference, requiring us to recommend what provision is required in the Hospital Service for congenitally malformed babies, imply a preliminary ethical question. Some babies are born for whom medical science can do nothing; but these apart, there is nowadays only rarely justification for adopting a passive attitude towards any deformed newborn baby who has a greater chance of survival than in the past. If surgical treatment is withheld, deformity and handicap may be very much more severe than if prompt action had been taken. New advances in medical knowledge are likely to improve still further the prospects for these children.

We are satisfied that on medical and nursing grounds alone, everything that is practicable should be done for these babies.

6. There are only a few active neonatal surgical centres providing all that is necessary in the particular area to meet the present demands both for immediate surgery and aftercare, and in many areas of the country facilities are inadequate. We hope that our report will be made available to the members of Regional Boards and Boards of Governors and their administrative staffs, as well as to those members of the Hospital Service who are professionally concerned with this subject, so that all may be aware of the evidence which shows the urgent necessity for the provision or the expansion of the hospital services discussed in this report.

CHAPTER II. CONGENITAL MALFORMATIONS

CLASSIFICATION

7. We first reviewed the recognised forms of congenital malformation to determine those which may be amenable to surgical treatment. These were classified into three groups:

A. Overt malformations, apparent on day of birth.

B. Hidden malformations which cause disturbance of function.

C. Hidden malformations which cause no immediate disturbance of function and which must be sought on routine examination.

The detailed groupings are shown in Appendix I of this report. It will be noted that the conditions for which immediate or early surgical opinion is or may be necessary are distinguished from those which normally will not need treatment until somewhat later in life. Some of the conditions listed are so rare that individually they may be disregarded for the purpose of calculating the hospital provision which is needed in an area or region. For some other conditions surgical opinion and advice may be needed at a very early stage for the better information of parents, although operation may not be necessary within the neonatal period. Although for the purposes of our further studies we have been able to leave a number of conditions out of consideration, we think the complete classification of congenital malformations and other congenital disorders for which surgical treatment is available is of interest.

INCIDENCE

8. We have not found it easy to arrive at accurate estimates of the incidence of those congenital malformations which call for surgery or surgical advice during the neonatal period. We considered statistics derived from the Hospital In-patient Enquiry; but these figures showed only how many patients with these disabilities were treated in hospital. This was only an indication of practice in the year in question (1961), and did not bear any relation to the number of babies born with these disabilities in that year. We were also provided with certain statistics for 1964 by the General Register Office, who pointed out however

that this was the first year for which this information had been collected; and since these figures were based on reports of conditions observable at birth, incidence was inevitably understated to a degree varying with the particular condition. It was known, for instance, that the figures for congenital heart disease represented only a fraction of actual cases.

9. We have, however, been able to make use of information drawn from the following sources:

(i) The Liverpool Congenital Abnormalities Registry. This provided comprehensive details of malformations in 91,000 consecutive births to mothers domiciled in Liverpool and Bootle, during the five years 1960 to 1964, with data for stillbirths and neonatal deaths.

(ii) The Birmingham Congenital Abnormalities Registry. This provided full details of malformations in 95,000 consecutive births to mothers domiciled in Birmingham, during the five years 1955 to 1959, with data for stillbirths and first day deaths.

(iii) Alder Hey Children's Hospital neonatal surgical unit. Particulars of admissions from a population of about three million (about 60,000 births annually) during the twelve years 1953 to 1964.

(iv) Sheffield Children's Hospital neonatal surgical unit. Admissions from a population of about three and a half million (about 70,000 births annually) in the twelve months from March 1964.

(v) Particulars of the numbers of neonatal patients admitted to hospitals in the South-Eastern Region, Scotland, in 1964. These admissions were from a population of about 1,100,000; the number of live births in the Region in 1964 was 21,884. The area served by the hospitals in the South-Eastern Region is fairly sharply defined and the rates quoted are considered to be reliable indices. Efforts were made to obtain similar information in respect of the Glasgow hospitals, but the population from which their cases were drawn was too indefinite to permit any calculation of rates of incidence.

This information is summarised in Appendix II (items (i) to (iv) above) and Appendix III (item (v) above). In our view, the figures from the different sources are reasonably consistent, bearing in mind the possibility of a certain amount of difference in classification of conditions, and that admissions to neonatal surgical units are inevitably less than total incidence.

10. We have included also at Appendix IV the statistics provided to us by the General Register Office, and referred to above. We consider that these figures, relating to England and Wales generally, support the assessments included in Appendix II and referred to in paragraph 9 above. They also correspond reasonably well, allowing for the difference in populations covered by the statistics, with the rates in Appendix III. It should however be noted, in addition to the point made in paragraph 8 above, that the figures from the General Register Office relate to conditions, and not to patients. Thus in the

tables in Appendix IV a baby exhibiting two of the abnormalities listed has been counted twice. To the extent that the treatment of the two (or more) conditions could be undertaken simultaneously by the same doctors and nursing staff, therefore, a calculation of hospital beds etc., based on these figures would be over-stated.

11. The figures in Appendix IV bring out very clearly the regional variation of incidence. It is probable that the differences between regions are in part accounted for by different standards of diagnosis and reporting; and in the case of the rarer abnormalities the number of cases occurring in a region in the year of the enquiry was too small for the comparison of rates per 1,000 births to be very useful. Nevertheless when full allowance is made for these factors there remain, in our view, true variations of incidence which are so far unexplained.

12. It is evident from the figures in Appendices II, III and IV that the largest group of abnormalities for which surgery is desirable or necessary in the neonatal period is those affecting the Central Nervous System, of which the most important is spina bifida cystica. (We are not overlooking conditions which need early diagnosis but which do not call for a special hospital bed at this stage—for example, congenital dislocation of the hip and talipes). Spina bifida cystica includes a number of conditions, for example meningomyelocele, which are often associated with abnormalities of the spinal column, spinal cord and the Central Nervous System. Any one of these lesions may be associated with hydrocephalus and with paralysis of the limbs or abnormalities of the urinary tract and bowel. In any consideration of the hospital provision to be made for the treatment of congenital abnormalities, the importance of the spina bifida cystica group of conditions is increased by the facts that the average length of stay for the initial surgical treatment is considerably longer than for other conditions, and that on average the amount of time which these babies must spend in hospital in the course of their subsequent treatment is also considerably greater. The sub-committee's attention was therefore primarily directed to the problems arising from the hospital treatment of this group of conditions; and it will be appropriate to include a brief outline of the circumstances which have caused attention to be focussed on this subject.

HISTORICAL DEVELOPMENT

13. In the decade prior to 1900 deaths in England and Wales in the first year of life amounted to 153 per 1,000 live births. By 1965 the comparable figure was 19 deaths per 1,000 live births. During this period the number of deaths due to congenital abnormalities in relation to a standard number of live births has however shown little change with the result that the proportion of infant deaths from congenital anomalies has risen from one in 32 in 1900 to more than one in 5 today. For Scotland the pattern is not dissimilar; the infant mortality rate in 1900 was 129 per 1,000 live births, and in 1965, 23 per 1,000 live births. In 1900 the proportion of infant deaths from congenital anomalies was one in 48, and in 1965 this had become more than one in five†.

†Registrar General's Annual Reports and Quarterly Returns.

Spina bifida cystica

14. Up to a dozen years ago 94% of babies born with spina bifida cystica died of meningitis, of progressive hydrocephalus, or of the complications of paraplegia; 4% lived as permanent invalids in wheelchairs; and 1% were able to live an independent life after orthopaedic procedures had been carried out. Only one baby in a hundred grew up to live a normal life*. The development of methods to control hydrocephalus by ventriculocardiac drainage has completely altered the prognosis. Meningitic infection has to some extent been controlled by antibiotics. These successes led to increased attention being devoted to the limb paralysis and deformity. A controlled trial of immediate operative treatment against conservative management showed that a proportion of the lower limb paralysis found in children with meningomyelocele was developing because of failure to repair the defect at a sufficiently early time. Present assessments suggest that, provided closure is undertaken within the first 24 hours of life, nearly three-quarters of the babies with spina bifida cystica who are so treated survive and make a partial or complete recovery. About one-third of the survivors have normal or minimally paralysed lower limbs requiring no special orthopaedic treatment. One third have co-incident myelodysplasia with congenital paralytic deformities and partial cauda equina paralysis. Corrective orthopaedic procedures allow these children to walk without splintage or with minimal splintage and to attend schools for the physically handicapped. Their orthopaedic condition is similar to that following an average degree of poliomyelitic paralysis. The remaining third of the survivors have either a severe flaccid or upper motor neurone paraplegia of varying degree. A proportion of these can become ambulant with the help of splintage; others need a wheelchair.

15. Most of these children have a measure of bladder paralysis. Investigation is essential in the neonatal period and careful and continued treatment of this paralysis avoids the complications of hydronephrosis and bladder infection. Correct subsequent management on conservative lines in boys often allows complete social independence, but in girls ileal or colonic conduit or ureterostomy operations may be needed to give social independence. In some a type of automatic bladder may develop comparable to that of patients treated for traumatic paraplegia. Concerted effort will almost certainly lead to progress in this field similar to that achieved in traumatic paraplegia, but incontinence is now manageable and should no longer be regarded as a contra-indication to orthopaedic surgery for the correction of deformities and is certainly not a bar to eventual employment.

16. The results of a follow-up of patients treated for spina bifida during the five years 1959 to 1964 by the Sheffield Children's Hospital neonatal surgical unit were as follows:—

Out of every 100 babies treated at the unit:

Early mortality	30 died
	70 lived

*Sharrard, 1966—personal communication.

Urology

Of the 70 who lived:—	15 had no bladder problems
	25 needed operative treatment to achieve satisfactory urinary function
	25 achieved satisfactory urinary function with conservative management
	5 died of urological complications.

Orthopaedics

Of the 70 who lived:—	22 had no orthopaedic problems or minor ones
	27 needed multiple reconstructive procedures but would achieve independent walking
	13 needed some orthopaedic procedures and would achieve partially independent walking
	8 would permanently need wheelchairs

Education

Of the 70 who lived:—	55 had normal mental development and were receiving normal education even if physically handicapped
	10 were educable at E.S.N. Schools
	5 were ineducable

17. It will be convenient at this point to note briefly the parallel developments in respect of other congenital conditions.

Congenital heart disease

18. Congenital heart disease forms the second largest group of congenital malformations. Rapid development has taken place in heart surgery during the last few years and palliative treatment is now giving way to definitive correction by various means. With the recent development of the heart-lung by-pass machine and its variants, prolonged operations on the open heart have become possible and the scope of cardiac surgery has been correspondingly widened. Of all the people who die of congenital heart disease 60% do so within the first year of life. A proportion of these may never be suitable for surgical intervention because of the complexity of the heart lesions or the co-existence of abnormalities in other organs or systems. Cardiac surgery of infancy is at present being practised routinely in only two or three centres and there is need for a few more centres to undertake this highly specialised work.

Malformations of the gastro-intestinal tract

19. Malformations of the gastro-intestinal tract, which form the third largest group of congenital anomalies, were, apart from congenital pyloric stenosis, usually fatal until a decade or so ago. Between the years 1938 and 1958 there was a marked decrease in deaths from these causes, mainly due to reductions in deaths from pyloric stenosis. Most of these infants are otherwise normal and early surgical intervention may result in a lasting cure. Although pyloric stenosis has been treated by operation for over 50 years it is only in the last decade that patients have reached the surgeon in a sufficiently good condition to minimise the hazards of an operation. The present mortality rate after surgery may be as little as one per cent or less in good centres. The mortality rate from the other forms of intestinal obstruction is still high although recent improvements in diagnosis and treatment have resulted in a higher survival rate.

CHAPTER III. HOSPITAL PROVISION

20. The hospital treatment of congenital malformations falls naturally into two parts—the provision to be made for initial surgical treatment, and the arrangements needed for rehabilitation and aftercare.

NEONATAL SURGICAL UNITS

21. The sub-committee decided that it would not be practicable for them to provide a standard blueprint for the surgical units considered to be necessary. The size of populations served by hospital regions in England, Wales and Scotland varies from under half a million to approaching five million, and this alone would rule out the possibility of a single type of provision. Other factors which must influence the development of this special provision are the incidence of congenital abnormalities, the nature of the existing hospital services, the availability of medical and nursing staffs, the density of population, the transport arrangements in the region, and whether a neonatal surgical service is being provided for populations outside the region or the area served by the normal hospital services. Moreover, in the view of the sub-committee, even were a standard pattern possible it would not in present circumstances be desirable. The field of neonatal surgery is one in which great progress has been made in recent years but it is evident that much research and pioneer work remains to be done and there should therefore be the maximum opportunity for local initiative.

22. If it were possible to ignore all the practical considerations which must affect the provision made in any region, the sub-committee would recommend that neonatal surgical units should always be located in children's hospitals or in large children's units of general hospitals. There would thus be available a comprehensive range of hospital services, including long-stay beds; and these services would be specifically orientated to the care of babies and young children. In certain hospitals, the need may be met by specific allocation of a number of cots for surgical cases, with all necessary additional facilities. Units might also be linked with other specialist units such as cardiac surgical units provided that

there was in each a strong awareness of paediatric needs and that trained children's nurses were available. Probably the minimum bed complement for such a neonatal surgical unit should be ten, if it is to be adequately equipped and staffed with trained nurses. The smallest units might not deal with the full range of congenital malformations. No firm figure can be given for the maximum size of a neonatal surgical unit, but it might be of the order of 25 to 30 beds.

23. One of the more difficult problems in some regions will be to determine the number of such units to be established. It is sometimes argued that the larger the number of units, and the more widely they are distributed, the easier it would be to arrange for the early admission of babies needing urgent surgery. On the other hand, these very specialised units must be able to call upon the services of a full team of paediatric anaesthetists, radiologists, pathologists and supporting technical staffs. At the present stage of development of this work this requirement would probably be difficult to satisfy in most cases. Moreover, these babies travel well provided suitable arrangements for the journey can be made. If the situation developed that there were a number of small units and one or two large ones, the tendency would be for the large unit or units to be under pressure while the small units were under-used, and the efficiency of both types of unit would consequently suffer. On balance, therefore, we consider that in most areas it will be preferable to establish a large unit or units rather than a number of smaller units.

REHABILITATION AND AFTERCARE

24. By far the greatest load on the hospital services dealing with rehabilitation and aftercare will be derived from cases of spina bifida. The sub-committee therefore considered that they could most usefully discharge this part of their remit by a detailed discussion of the hospital requirements of these patients, together with a rough assessment in terms of beds and staffs of the necessary hospital provision. In the following paragraphs separate consideration is given to:

(a) Continuation of management of hydrocephalus;
(b) Management of bowel and bladder paralysis;
(c) Management of paralysis and deformity in the lower limbs;
(d) Bony operations on the spine;
(e) Social, educational and environmental management; and
(f) Organisation of rehabilitation and aftercare services.

Continuation of management of hydrocephalus

25. Ideally the surgical team that has originally been concerned with the investigation and management of hydrocephalus in the neonatal period should continue to follow-up the infant's progress. Some infants will have had ventricular drainage established during the neonatal admission; these will require follow-up to ensure that no blockage or other complication is overlooked: more than half of them will require revision of their ventricular drainage on one occasion and some on two or more occasions. Those who have not had ventricular drainage instituted in the neonatal period also require follow-up to

determine their need for ventricular drainage should it arise with time and growth.

26. Of every 100 children with meningomyelocele, about 80 have a significant degree of hydrocephalus. Approximately 40 need ventriculocardiac drainage during the neonatal period. A further 22 will need ventriculocardiac drainage during the first six months of life. Each of these groups may then be subject to the need for revision operation at any time during the next six years. By that time the need for further operation for hydrocephalus is much less but, among the survivors at this time, a few may still require further operation after five years. Calculation of the total numbers requiring operation is complicated by the fact that those with the most severe hydrocephalus are generally less likely to survive.

27. Among children treated by early closure those who survive the first three months of life (i.e., about 68%) are very likely to continue to survive; only a further 12% of the original numbers admitted to hospital can be expected to die for one reason or another during the next five years. Assuming, therefore, a hypothetical intake of 100 infants with meningomyelocele in any one year, 68 will still be alive at the third month and approximately 50 will be suffering from hydrocephalus. Thirty of these will have been survivors of those treated in the neonatal period and the remaining 20 will require their initial shunts. A study has shown that about two to three further admissions will be needed on average for each child who has to have ventricular drainage. Allowing for further mortality between the third month and the fifth year there will be a need for about a further 110 admissions, each for a period which is usually about four weeks including pre- and post-operative care.

28. For the surgical management of hydrocephalus after the neonatal period approximately 12 beds will be needed per 100 new cases of spina bifida cystica. After five years about 110 operations will be performed per year, each representing about half a session of operating time—55 sessions in all. A further 8 beds will be needed for medical neurological investigation and treatment. For the out-patient care of hydrocephalus, assuming that supervision will need to be continued for at least ten years, with an intake of 100 new patients per year, an average consultation rate of three visits per year, 68% of patients surviving the first three months of life and 56% of patients surviving the first five years of life, a centre commencing the treatment of hydrocephalus would need to expand from about 150 consultations in the first year to about 1,800 consultations per year after it had been established for ten years.

29. Mention should also be made of the examinations and the operations which will be needed to correct ophthalmological and hearing defects which are sometimes associated with hydrocephalus.

Management of bowel and bladder paralysis

30. Some interference with bowel control occurs in almost all children with meningomyelocele, but it seldom presents insuperable problems in management. There is no indication for major surgery and although some degree of rectal

prolapse is not uncommon only a few children require minor surgery in its treatment.

31. Pyelonephritis is a serious threat to survival. A pyelogram will be needed at some point during the first month in every child and those who later on require surgery will require at least one further pyelogram. For every hundred babies about two hundred X-ray urological investigations will be needed at some time or other.

32. Frequent testing of urine and the bacteriological examination of it for infection involves an extremely large amount of work for laboratory staff. Taking account of children who develop urinary infection as well as those who only need occasional urine tests, and allowing also for mortality, for every hundred children admitted with meningomyelocele (of whom 85 will have some bladder anomaly) the total number of individual investigations of urine per year is approximately 2,000 and cumulatively this will rise to between 16,000 and 18,000 per year when the centre has been established for ten to twelve years. Comparable considerations apply to the estimation of serum electrolytes and similar investigations of children as out-patients or in-patients.

33. As far as can be estimated, every child who suffers bladder paralysis needs to be admitted as an in-patient for bladder investigations for about one week every four years; and this is likely to continue until the child is about 12 years old. Assuming that of every hundred children admitted for neonatal surgery, 55 survive with paralysed bladders, by the time a centre has been established for twelve years about five beds will be needed for this purpose.

34. At the present time urinary diversion operations are generally being done in children more than 2–3 years old and much more frequently in girls than in boys. In the spina bifida group there is an approximately equal distribution of males and females, so that again assuming original admissions of one hundred per year of whom 55 survive with paralysed bladders, all the females (27), and one quarter of the males (7) will require urinary diversion at some time. As with other requirements, the beds needed for this purpose would increase during the first few years after a centre was established, and would eventually amount to about four beds. Apart from urinary diversion, surgery will be needed for bladder neck resection, renal calculus or other urological procedures. About four beds will be required for this purpose for every one hundred original admissions per year. Finally, beds will be required for the treatment of renal failure and for medical urology. The number of beds needed for these purposes depends to some extent on the success of management of bladder paralysis generally and infection in particular; so far, it appears that about seven beds are required for every hundred original admissions. Thus the total number of beds likely to be required for the management of bowel and bladder paralysis will be about twenty for every 100 new admissions per year.

Management of paralysis and deformity in the lower limbs

35. The need for orthopaedic treatment in patients with spina bifida cystica shows extreme variation. If it can be assumed that the ideal treatment of early

closure of the spinal lesion and proper management of the hydrocephalus has been undertaken, all cases of pure meningocele and 20% of those with meningomyelocele will have no lower limb paralysis and will not need any specific orthopaedic treatment. Sixty per cent of those with meningomyelocele or spina bifida occulta with neurological involvement have partial paralysis and 20% have complete or severe paralysis. Approximately 30% of children with meningomyelocele are born with lower limb deformity that needs correction. Others may develop secondary deformities.

36. *Operative treatment.* The number of orthopaedic operations that may be required can be as few as one and as many as sixteen. They may include an iliopsoas transplant, a femoral osteotomy, tendon transplants in the foot, and other foot operations. The average number of operations per 100 children admitted with spina bifida cystica is 410, comprising 160 major, 200 medium and 50 minor operations. This represents approximately 200 surgical operating sessions and the use of 30 beds.

37. *Non-operative orthopaedic treatment.* Out of every 100 new patients with spina bifida cystica admitted, 20 will ultimately have severe paralysis and will need a period of in-patient care during which time they will be fitted with braces and splints and taught to walk. The average period of stay for patients of this kind is four months. Some of them will also need surgical procedures for this but the estimate for this need has been included in the paragraph above. The bed need for this purpose may amount to about seven beds; but this would be somewhat reduced in areas which are adequately equipped with schools for handicapped children, since patients could spend part of the time needed for these procedures at such a school. Allowance must also be made for the accommodation of mothers who are admitted to learn of and to help with the treatment and training of these children. An adequate physiotherapy service and the ready supply of surgical braces, calipers, footwear and other appliances is essential. The surgical appliances need expert manufacture to meet each child's individual requirements and they are expensive. Delay in the supply of these appliances is very undesirable, since until they are supplied children must be kept in a hospital bed to avoid the risk of further deformities developing.

Bony operations on the spine

38. In a few cases of children over the age of eight years, it is found that operations for spinal deformity are needed. These are major procedures and the child may have to be an in-patient for at least three months and sometimes for six months. There is so far very little experience on which to base estimates of bed requirements, but it is thought that in a centre dealing with 100 new admissions per year, about 5 per year will eventually require major spine surgery and will require two beds and seven operating sessions.

Social, educational and environmental management

39. Much of this aspect of the problem falls outside the terms of reference of the sub-committee, and is appropriate to the educational and welfare services of

the country, between whom and the hospital authorities there will have to be close collaboration and exchange of information; but the hospital authorities should not need to accept any more direct responsibilities. However, two matters do concern regional hospital authorities. First, children with spina bifida cystica are more likely than average to suffer from illnesses in general and are specially likely to develop pneumonia. A number will also have attacks of meningitis or other neurological complaints for which they will need to be admitted to hospital. Secondly, on the basis of present experience it may be assumed that about 5% of all babies originally admitted to hospital with spina bifida cystica will survive as seriously retarded children requiring institutional care. On the assumption of an annual intake of 100 babies with spina bifida cystica, about six general paediatric beds are likely to be needed for general paediatric illnesses. The bed requirement for the seriously retarded patients will be considerable, but will largely have to be met in mental subnormality hospitals, including in due course a few in adult wards.

Organisation of rehabilitation and aftercare services

40. The further management of hydrocephalus should normally be continued by the team responsible for the neonatal surgical management of the child. Since this is likely to be available only at specific centres, periodic out-patient reviews and in-patient surgical treatment would almost certainly have to take place at these centres.

41. Urological management on a day-to-day basis can be accommodated satisfactorily by local paediatric services but much of the more specialised treatment, particularly surgical urology, pyelography and much of the medical urology requires specialised facilities both as regards consultant care and laboratory facilities for micro-analysis.

42. The orthopaedic surgery of paralysis and paralytic deformity in children is not appropriate for most general orthopaedic departments and most of it, at any rate for the next fifteen to twenty years, will have to be undertaken at centres with special experience and with attachments to long-term hospitals of the type previously needed for the treatment of tuberculosis or poliomyelitis. Where these centres are divorced from normal paediatric, surgical or neurological services. such facilities will have to be provided, to ensure appropriate cover for any mishaps that may arise in relation to hydrocephalus or urinary tract involvements.

43. The ideal provision is a children's hospital or large paediatric department that can cope with the surgical, urological and general paediatric management of the child, together with some of the orthopaedic management; and this can be linked with one of the long-term orthopaedic hospitals to take a share in the orthopaedic load, which is the greatest. How this can best be achieved is a matter for each region to decide. If separate surgical, urological, paediatric and orthopaedic departments work independently of each other, the child may have to undertake multiple visits to various hospitals to obtain the necessary care. Ideally, the work should be carried out by teams in which each specialty is represented, preferably in one hospital but with some outside facilities for special

purposes such as long-term hospitals working in association. If it is possible for out-patient clinics to be run at which each representative is present and can see the child on the same day, management becomes much more effective and a good deal of time is saved. Each discipline will benefit considerably from having a working knowledge of what is being done or is to be done for the child in the other specialties.

44. It may be considered that some greater degree of decentralisation of services than is advocated above would be more helpful to the patients and their families, since they would be spared the possibly long journeys to the single centre. However, the experience of those who have been concerned in the management of these children suggests that parents generally do not object to having to bring the children back to the original hospital for follow-up examination and treatment—on the contrary, there seems to be a tendency to consider that the original hospital would know more about these babies and their needs. In some regions it may be possible to reduce the amount of travelling to be done by patients and their parents by arranging for the paediatrician or surgeon from the regional centre for this work to have peripheral clinics. We would also expect that once services were properly organised on a regional basis, delegation of part of the work to peripheral centres would develop naturally, and a certain amount of the more routine follow-up work (for example urine testing, or X-rays provided that adequate precautions are possible for minimising the radiation dosage) would be arranged at local hospitals.

CHAPTER IV. MEDICAL STAFFING REQUIREMENTS

45. The sub-committee has already indicated its view that a neonatal surgical unit should have access to at least ten cots. Any lesser number is unlikely to justify the provision of full ancillary services of the special nature required in radiology, pathology (including biochemistry and bacteriology) and indeed in nursing. Unless there is an adequate through-put of patients (which we do not think would arise if a unit were of less than ten beds) there will be insufficient operative experience for the surgeons concerned, or for the training of junior staff. As in other fields of specialised surgery, team-work is absolutely essential and an arrangement whereby a paediatric surgeon is expected to work with a team of juniors who are neither particularly interested nor trained in this field is unsatisfactory. We consider that ideally the surgery of the neonatal period should be undertaken by paediatric surgeons, but particularly in smaller centres we would not preclude such work being undertaken by fully trained general surgeons who had additionally both training and experience in this particular field and who were prepared to devote at least four or five sessions a week to paediatric surgery. Even within the area of paediatric surgery at present recognised there is a degree of specialisation towards urology, neurology, cardiology and plastic surgery in individual cases, and we expect that with the further centralisation of the surgery of childhood it is likely that such subdivisions will increase.

46. We would however regard it as undesirable that any surgeon, neurosurgeon, neurologist, paediatrician or orthopaedic surgeon should devote the whole of his time to the neonatal group of conditions and it must be presumed that the surgery and management of congenital malformations would be spread among a number of individuals who would also undertake other kinds of surgical and medical work.

47. There must necessarily be a greater number of fully trained paediatric surgeons if a programme of essential neonatal surgery is to be undertaken. At the present time there are in this specialty only four senior registrar posts in the whole of England and Wales and Scotland, and their geographical distribution is not well balanced. These numbers may prove to be not unreasonable when there is a full complement of consultant paediatric surgeons, but it is difficult to see how the necessary expansion of consultant staff is to be achieved from such a limited number of training posts. We recommend that there should be an urgent examination of measures which might be taken to supplement the present training arrangements in this specialty with a view to ensuring that the development of hospital facilities for the surgical treatment of congenital malformations is not held up by lack of trained medical staff.

48. It is now generally accepted that at the senior house officer/registrar level doctors should be given experience of several specialties as well as general grounding in surgery or medicine as the case may be; and we hope that to an increasing extent a term of experience in paediatric surgery will be included in the training of surgical registrars.

49. At the undergraduate medical schools, there is a shortage of teachers in this specialty, and we would regard it as very desirable that additional chairs should be created, or posts for senior lecturers or readers in paediatric surgery, in the big general surgical schools.

50. Enclosed at Appendix V of this report is a memorandum prepared by members of the sub-committee discussing in more detail the present medical staffing of this specialty and the measures needed to secure the necessary increase in numbers.

51. With regard to the later care of the disabled baby, we feel it is necessary to emphasise that there are certain surgical specialties which are increasingly dealing with children and yet whose training programmes have not in the past provided adequate experience in the very particular problems of the youngest age group. With the run-down of long-stay orthopaedic hospitals consequent on the decline of tuberculosis and poliomyelitis, orthopaedic surgeons may reach consultant level with virtually no experience in the management of the deformities of small children. Similarly in neurology and neurosurgery, specialties which make particularly heavy demands on the time of those engaged in them, training has in the past with very few exceptions been limited to adult patients: in consequence very few established neurology or neurosurgery centres have either nursing or medical staff experienced in the peculiar problems of the first few years of life.

CHAPTER V. NURSING STAFFING REQUIREMENTS

52. We attach cardinal importance to the provision of nursing staff adequate both in numbers and in quality. This is vital whether neonatal surgical patients are nursed in wards specially designed to accommodate them or in general infants' wards. The nurse/patient ratio should broadly speaking be very much the same as in intensive care units, although the actual numbers needed will of course depend upon the types of illness being nursed in the unit or ward, the number and quality of the supporting staff, and the architectural arrangement of the hospital. More nurses are needed when there are many cubicles.

53. The nursing undertaken in neonatal surgical units is of two general types — intensive care, in the circumstances outlined in paragraphs 55–61 below, and skilled "nannying" of the babies at other times. Because the maximum continuity of care and experience is essential, most of the nursing staff should be qualified nurses, whether S.R.N. (Registered General Nurses in Scotland), R.S.C.N. or S.E.N. It is to be expected that even in the larger units the number of patients will fluctuate considerably; and unless, exceptionally, nurses with the specialised training needed can be drawn at very short notice from other departments of the hospital, it will be necessary to cater for the maximum number. To ensure that nurses experienced in the special problems of the unit are available to the fullest extent, internal rotation of night duty is desirable. A sister should be on duty for each of the three shifts, in addition to any departmental sister with wider responsibilities. She should be supported by at least one staff nurse, who may be undertaking postgraduate training.

54. For the reasons indicated in paragraph 52 we are unable to lay down the precise numbers of nurses required for staffing neonatal surgical units; but the considerations mentioned in paragraph 53 would justify nursing establishments on something like the following lines for units of 18 and 10 cots respectively. In each case it has been assumed that a milk kitchen and all other normal services are already provided within the hospital.

For 18 cots:—

1	Superintendent or sister-in-charge (General and Sick Children's Register)
3	Sisters (Sick Children's Register)
6	Staff Nurses (General or Sick Children's Register)
3	State Enrolled Nurses
4	Student Nurses
3	Nursing Auxiliaries
20	

For 10 cots:—

1 Superintendent	qualifications as above
3 Sisters	
4 Staff Nurses	
2 State Enrolled Nurses	
2 Student Nurses	
2 Nursing Auxiliaries	
14	

55. The nursing care of the neonatal surgical case is immensely complex and requires perhaps more skill and experience that any other form of nursing. The problems can be considered under four headings:

1. The care of any sick newborn baby
2. The pre- and post-operative care of the neonate
3. Non-surgical intercurrent illness of the newborn especially the premature
4. The understanding and use of equipment for monitoring or treatment.

56. The adult patient who is semi-conscious, unable to feed himself, doubly incontinent, suffering from defective control of body temperature and lacking immunity to certain infections would be regarded as needing almost constant nursing care. It is sometimes forgotten that *every* sick newborn baby is such a case—only less of a burden from the nursing standpoint in that he is easier to lift. It is essential that accurate records should be kept of such bodily functions as heart rate, respiratory rate and temperature and all of these are harder to measure clinically than is the case with an adult. It is unnecessary to detail the practical aspects of infant feeding but this again demands skill, experience and judgement. Lastly, the strictest discipline and control has to be observed to avoid cross-infection.

57. The scaling down of apparatus, drug dosage, fluid requirements, etc. only scales up the difficulties of accurate administration. Parenteral drugs usually have to be measured in Mantoux syringes; intravenous drip transfusions are not only difficult to set up and maintain in the newborn but also to keep running at the very slow rate required. The danger of indwelling tubes in chest or belly being dislodged by an active baby is very real; the application of dressings to surgical wounds is made more difficult by the size and shape of the baby and the delicate and sensitive nature of the baby's skin.

58. It is this aspect of neonatal nursing care which is the most demanding. In this connection it must be realised that the adaptation to extra-uterine life involves rapid physiological changes in the first few days of life and that departure from or indeed reversal of these changes may take place with equal rapidity. Emergencies in the neonatal period frequently require immediate attention in order to prevent disaster. The respiratory tract is the most frequent source of

problems and complications in the newborn infant. This especially applies to the prematurely born infant and in this connection it should be remembered that a number of malformations requiring surgery are significantly associated with premature birth. Aspiration of mucus or milk into the respiratory tract is especially serious because of the small calibre of the bronchi: it demands instant recognition and intervention. (Oesophageal tube feeding is necessary in almost all infants below 34 weeks' gestation and in many of greater maturity and can easily lead to aspiration if carried out by an inexperienced nurse.) Recurrent apnoeic attacks in the small premature baby present a similar and equally serious problem. The respiratory distress syndrome and pneumonia are liable to develop in any premature infant especially following general anaesthesia. Modern treatment of the ill neonate involves catheterisation of umbilical artery and vein for serial blood gas analysis, blood glucose determinations and so on and this again makes demands on the nursing staff. It should be emphasised that while in a favourable case of neonatal surgery special care may be needed for no more than 48 hours, in some cases serious problems continue for many days.

59. Most newborn babies whose surgery is complicated by such circumstances will need the undivided attention of one nurse and this demands an establishment of four, one for each 8-hour shift per 24 hours of duty and another to cover off-duty and meal times.

60. The increasing use of monitoring apparatus for measuring heart rate, respiratory rate, blood pressure, etc. in the newborn is more in the interests of accuracy and serial determinations than of easing the burden of the nursing staff who must be familiar with the equipments involved and know when they have gone wrong. For the treatment of the ill newborn baby, incubators are universally used and these are highly complicated machines which require considerable understanding and careful supervision. Exactly the same applies to mechanical respirators which may be necessary for hours or sometimes days post-operatively.

61. It seems that the special knowledge and experience needed for the pre- and post-operative care of the neonatal surgical case is more likely to be possessed by those familiar with the general illnesses of newborn babies rather than with the surgical nursing problems of older children and adults although both types of nursing experience are desirable.

CHAPTER VI. STAFFING REQUIREMENTS FOR RADIOLOGY, PATHOLOGY AND ANAESTHETICS

62. Mention has already been made of the need to provide special radiological and pathological services. It is only in children's hospitals and in large children's departments that adequately trained technicians are likely to be available for emergency work. Normal emergency stand-by radiology arrangements are unsuitable for neonatal investigations. It is clearly an advantage if one of a team of consultant radiologists can obtain special experience in this work, and the sub-committee considers that the large children's units should be encouraged to provide facilities for gaining special experience for radiologists

and radiographers, pathologists and laboratory technicians, including those from hospital groups with large maternity units. Such a scheme of secondment for training should be instituted in each Regional Board area.

63. The administration of general anaesthesia to a newborn baby demands an extremely high degree of skill. Very few consultant anaesthetists established in hospital practice today have had experience in this type of work and it is unfair that any anaesthetist should be called upon unless he has had special training. It is common practice with the general level of understaffing in the hospital service today for the 'on-call' emergency anaesthesia to be provided by a registrar on duty for a whole group of hospitals. Such an individual should never be required to undertake neonatal work unless he has had special training beforehand. Provision of an adequate anaesthetic service presents the same difficulties as the provision of a surgical service in that one consultant cannot be expected to be available day in and day out without a break. The anaesthetic requirements therefore underline once more the essential need to centralise the neonatal service to ensure that the surgeon is never called upon to operate with unskilled anaesthetic cover. Even in some children's hospitals there may likewise exist a state of affairs where perhaps only one out of four anaesthetists has adequate experience in the neonatal period of treatment. It is therefore recommended that the attention of Regional Hospital Boards be particularly called to this need and arrangements be made for secondment of consultants where necessary. A wider use of the 'pastoral visit' system for providing special consultant service could well be appropriate here. With the accelerated rate of promotion which exists in this specialty today it is unlikely that any but a very few senior registrars reaching consultant status will have been specially trained in neonatal anaesthesia.

CHAPTER VII. THE CONTRIBUTION OF THE MATERNITY SERVICES

64. It is sometimes possible to forecast the likely delivery of a congenitally abnormal child. For example, pregnancy following birth of a previously abnormal child; hydramnios or oligohydramnios in the current pregnancy; mothers suffering from endocrine disorders (e.g. hypo- or hyper-thyroidism or diabetes); primigravid breech; extreme youth, or age over 35 years; all are associated with an increased risk of some form of congenital anomaly. In cases where there is reason to believe that there is a high risk of congenital anomaly, an X-ray examination is not sufficient positively to exclude even bone deformity. Foetal E.C.G., ultrasonics, maternal hormone excretion and cytogenetics of liquor are among the more sophisticated tests which can occasionally be employed to forecast anomaly.

65. The Royal College of Obstetricians and Gynaecologists has always recommended that mothers whose children are likely to be abnormal should be delivered in a consultant unit. When it is expected that the baby will be malformed, arrangements should be made for the mother to be cared for by a consultant obstetrician in a fully equipped consultant unit and wherever possible

delivery of the baby should be undertaken in a large centre where special facilities are available for investigation and therapy of any congenital anomaly.

66. We recommend that where such arrangements are not already made, hospital authorities should organise regular perinatal mortality conferences, with the object of identifying any deficiencies that may arise in the neonatal surgical services. These conferences should be preceded by post-mortem examinations of perinatal deaths by a pathologist who is interested and experienced in neonatal work. They should also of course have available the clinical obstetric and paediatric records.

67. Ideally, every baby born in hospital should be examined within a few hours of its birth by a paediatrician specially experienced and trained in the care of the newborn. A weekly visit of a paediatrician to a maternity unit is not really sufficient and delays brought about by arrangements such as this often put the baby in jeopardy. However, the sub-committee recognises that in a great many cases it is the obstetrician who is responsible for examining the newborn baby and arranging urgent surgical treatment; and in fact the majority of overt congenital malformations which require urgent surgery will be recognised by the obstetrician. In the case of babies born at home or in general practitioner maternity units the responsibility for the initial examination rests with the general practitioner. As already occurs in many hospitals, obstetricians or general practitioners, in consultation with their paediatric and surgical colleagues should have a pre-arranged plan which determines the necessary transfer and therapeutic programme for these easily recognisable conditions. If for any reason a paediatrician is not immediately available neither the decision to operate nor the necessary arrangements for transfer should be delayed; but wherever possible the decision for operation or therapy should be taken in the light of the prevailing local circumstances and after consultation between the obstetrician, the paediatrician and a surgeon specially trained and experienced in the requisite field.

68. The examination of the newborn with special reference to anomalies should be part of the formal training of medical students and midwives and should be specially emphasised in all postgraduate training. The obstetricians, paediatricians and midwives in all maternity units, and all general practitioners and district midwives should be aware of the possibilities of modern therapy, know the local arrangements for such care, and have some knowledge of the immediate post-natal care of such babies.

69. The success of the surgical treatment of the newborn depends in many instances upon early diagnosis and treatment, the period to be measured in hours rather than days from the time of birth. We therefore recommend that special arrangements similar to those recommended by the joint sub-committee of the Standing Maternity and Midwifery Advisory Committee and the Standing Medical Advisory Committee for the emergency resuscitation and transport of premature babies should be made.

70. When the baby is born in a hospital which does not have the facilities for neonatal surgery, the baby should be transferred in a portable incubator accompanied by a trained nurse or midwife or exceptionally by a doctor. Normally the

baby will be transferred by ambulance but where long distances are involved it may be necessary to go by rail or by air transport.

71. When the baby is born at home or in a general practitioner unit it will be necessary to call upon the emergency resuscitation team consisting of a consultant paediatrician or senior member of his staff and a trained nurse; the team having transport and resuscitation equipment. Where the distances involved are not too great, it should be possible to transfer the baby straight to the neonatal unit accompanied by the nurse and/or doctor. Where however the distances are great and there may be some delay in making the necessary arrangements, it may be advisable to remove the child firstly to the nearest special baby care unit.

72. In the opinion of the committee these babies are well able to withstand long journeys provided that trained staff and a good portable incubator are available.

73. It is essential however that a proper scheme is worked out and that general practitioners and hospital staff know that a service is immediately available and how it can be summoned.

APPENDIX I

Congenital malformations and other congenital disorders for which surgical treatment is available (see para. 7)

Note—Capital letters are used for conditions in which immediate or early paediatric or specialist surgical opinion is or may be necessary.

*Treatment sometimes wholly or in part medical.

A. Overt malformations, apparent on day of birth

Central Nervous System	HYDROCEPHALUS (some) MENINGOMYELOCELE MENINGOCELE ENCEPHALOCELE
Eye	Strabismus Ptosis Coloboma of lid Limbal or conjunctival dermoid
Cardiovascular System	CAVERNOUS HAEMANGIOMA LYMPHANGIOMA
Ear, neck and face	Accessory auricle Branchial cleft and fistula
Alimentary Tract	EXOMPHALOS IMPERFORATE ANUS INCARCERATED HERNIA CLEFT PALATE (some) Hare lip Herniae (inguinal, femoral) (some) Persistent omphalomesenteric duct
Genito-urinary Tract	FEMALE PSEUDOHERMAPHRODITISM* ECTOPIA VESICAE TORSION OF TESTIS Patent urachus Sarcoma botryoides
Upper limb	Malformations of arm and hand (esp. polydactyly, syndactyly)
Lower limb	TALIPES EQUINOVARUS Malformations of leg and foot (esp. polydactyly, syndactyly)
Other Musculo-skeletal	Tumours—TERATOMA SARCOMA Craniostenosis (some)
Monsters	Conjoined twins

B. **Hidden malformations which cause disturbance of function**

Central Nervous System	Meningocele (anterior)
Eye	Stenosis of nasolachrymal duct Distichiasis Entropion
Cardiovascular System	TRANSPOSITION OF GREAT VESSELS ANOMALOUS VENOUS DRAINAGE PATENT DUCTUS ARTERIOSUS COARCTATION OF AORTA VASCULAR RINGS OTHER CARDIAC DEFECTS
Alimentary Tract	PIERRE ROBIN SYNDROME OESOPHAGEAL ATRESIA DIAPHRAGMATIC HERNIA PYLORIC STENOSIS* TRACHEO-OESOPHAGEAL FISTULA INTESTINAL ATRESIA PERITONEAL BANDS MALROTATION OF GUT DUPLICATION OF GUT HIRSCHSPRUNG'S DISEASE MECONIUM ILEUS ABDOMINAL TUMOURS RUPTURE OF LIVER GASTRIC PERFORATION MECONIUM PERITONITIS Hiatus hernia* Oesophageal pouch Tongue tie Biliary atresia Vesico-rectal fistula
Respiratory Tract	CHOANAL ATRESIA LARYNGEAL STENOSIS: CYSTS AND TUMOURS LOBAR EMPHYSEMA PULMONARY CYSTS MEDIASTINAL CYSTS
Genito-urinary Tract	OBSTRUCTIVE LESIONS (e.g. structure of uretero-vesical orifice, posterior urethral valves, stricture of urethra etc.) RENAL TUMOURS RENAL VEIN THROMBOSIS TORSION OF THE OVARY OVARIAN CYST

C. **Hidden malformations which cause no immediate disturbance of function and which must be sought on routine examination.**

Central Nervous System	CONGENITAL DERMAL SINUS HYDROCEPHALUS (some) Diastematomyelia
Eye	GLAUCOMA RETINOBLASTOMA Cataract*
Cardiovascular System	Structural defects of heart
Alimentary Tract	CLEFT PALATE (some) HERNIA INTO CORD Herniae, (inguinal, femoral) (some) Ectopic anus
Genito-urinary Tract	Cryptorchidism Hypospadias Hydrocele
Lower limb	DISLOCATION OF HIPS
Other Skeletal	Spinal curvature Craniostenosis (some)

APPENDIX II

Incidence rates and hospital admissions for certain congenital anomalies—English sources (see para. 9)

Anomaly	Incidence rates		Hospital admissions		Estimated potential admissions per 10,000 births
	Liveborn/1,000 births		Admissions/1,000 births		
	(1) Liverpool (1960–1964)	(2) Birmingham (1955–1959)	(3) Liverpool (1953–1964)	(4) Sheffield (March 1964–Feb. 1965)	
Meningomyelocele and/or hydrocephalus ...	3·1	2·5	2·4	2·4	25
Oesophageal atresia ± t - o fistula	0·14	0·27	0·25	0·29	3
Intestinal obstruction	0·65	0·33	0·62	0·6	6
Anorectal anomalies	0·35	0·30	0·22	0·3	3
Obstructive uropathies	—	0·1	0·12	0·2	2
Exomphalos	0·2	0·25	0·15		2
Diaphragmatic and thoracic anomalies	0·44	0·35	0·1	0·11	2
Others (tumours: biliary atresia)	0·08	—	0·06		1
Pyloric Stenosis				1·5	15
Congenital heart disease	5·5	(Neonatal deaths 1·1/1,000, of which about one third potentially operable)			4

APPENDIX III

Hospital admissions for certain congenital anomalies—Scottish source
(see para. 9)

Neonatal patients admitted to hospitals in the South-Eastern Region, Scotland, 1964

Anomaly	Number of Cases	Rates per 1,000 Live Births
Spina bifida, hydrocephalus, encephalocele	43	2·0
Oesophageal atresia and/or tracheo-oesophageal fistula	3	0·14
Intestinal obstruction	11	0·5
Anorectal anomalies	4	0·18
Obstructive uropathies	6	0·27
Exomphalos	2	0·09
Diaphragmatic anomalies	1	0·05
Miscellaneous alimentary	5	0·23
Congenital hypertrophic pyloric stenosis (cases under 1 month old only)	18	0·82
Vomiting—cause unknown (cases under 1 month old only)	16	0·73
Cleft lip and palate (cases under 1 month old only)	3	0·14
Miscellaneous	4	0·18
Congenital heart disease	—	—
Congenital dislocation of hip	—	—

APPENDIX IV

Information from the General Register Office on the occurrence of certain congenital anomalies in England and Wales in 1964 (see paras. 10-11)

1964 Numbers of cases reported in England and Wales

Anomaly	Newcastle	Leeds	Sheffield	East Anglia	N.W. Met.	N.E. Met.	S.E. Met.	S.W. Met.	Wessex	Oxford	South West	Welsh	Birmingham	Manchester	Liverpool	London	Total
†Spina bifida, hydrocephalus, encephalocele	117	137	176	40	102	80	58	58	71	70	130	132	204	254	81	89	1,799
Oesophageal atresia, and/or tracheo-oesophageal fistula	12	8	12	3	6	5	5	4	3	1	8	4	20	19	—	6	116
Intestinal obstruction	4	2	7	1	5	—	4	4	2	1	8	5	8	4	1	1	57
Anorectal anomalies	8	11	10	3	12	8	13	3	4	4	9	10	22	31	4	11	163
Obstructive uropathies	3	—	1	1	6	4	2	2	1	—	5	1	6	3	—	2	37
Exomphalos	6	14	9	5	4	10	8	2	6	6	11	13	22	15	2	11	144
Diaphragmatic anomalies	2	2	3	3	1	3	1	4	1	3	4	3	2	—	—	1	33
†Others (i.e. Hirschsprung's disease, defects of liver and biliary tracts)	4	2	2	2	3	—	1	4	1	1	4	1	—	7	—	1	33
Congenital heart disease	46	38	76	24	43	38	32	53	31	23	61	58	133	82	29	25	792
Congenital dislocation of hip	10	20	11	10	19	8	9	12	6	7	22	10	121	36	15	23	339

1964 Rates per 1,000 live births

Anomaly	Newcastle	Leeds	Sheffield	East Anglia	N.W. Met.	N.E. Met.	S.E. Met.	S.W. Met.	Wessex	Oxford	South West	Welsh	Birmingham	Manchester	Liverpool	London	National average
†Spina bifida, hydrocephalus, encephalocele	2·07	2·36	2·09	1·41	1·28	1·31	0·92	1·08	2·14	1·98	2·53	2·78	2·13	3·06	1·79	1·40	2·05
Oesophageal atresia, and/or tracheo-oesophageal fistula	0·21	0·14	0·14	0·11	0·08	0·08	0·08	0·07	0·09	0·03	0·16	0·08	0·21	0·23	—	0·09	0·13
Intestinal obstruction	0·07	0·03	0·08	0·04	0·06	—	0·06	0·07	0·06	0·03	0·16	0·11	0·08	0·05	0·02	0·02	0·07
Anorectal anomalies	0·14	0·19	0·12	0·11	0·15	0·13	0·21	0·06	0·12	0·11	0·18	0·21	0·23	0·37	0·09	0·17	0·19
Obstructive uropathies	0·05	—	0·01	0·04	0·08	0·07	0·03	0·04	0·03	—	0·10	0·02	0·06	0·04	—	0·03	0·04
Exomphalos	0·11	0·24	0·11	0·18	0·05	0·16	0·13	0·04	0·18	0·17	0·21	0·27	0·23	0·18	0·04	0·17	0·16
Diaphragmatic anomalies	0·04	0·03	0·04	0·11	0·01	0·05	0·02	0·07	0·03	0·08	0·08	0·06	0·02	—	—	0·02	0·04
†Others (i.e. Hirschsprung's disease, defects of liver and biliary tracts)	0·07	0·03	0·02	0·07	0·04	—	0·02	0·07	0·03	0·03	0·08	0·02	—	0·08	—	0·02	0·04
Congential heart disease	0·82	0·66	0·90	0·84	0·54	0·62	0·51	0·99	0·93	0·65	1·19	1·22	1·39	0·99	0·64	0·39	0·90
Congenital dislocation of hip	0·18	0·35	0·13	0·35	0·24	0·13	0·14	0·22	0·18	0·20	0·43	0·21	1·27	0·43	0·33	0·36	0·39

Note:—These figures are based on local authority areas and the regions named do not exactly correspond with the hospital regions. Figures for the Metropolitan regions exclude London; numbers and rates for London are shown separately in the penultimate columns.

†In these groups the possibility of a baby having more than one of the anomalies has not been excluded. Rates are therefore of anomalies per 1,000 live births.

APPENDIX V

Memorandum on present medical staffing and postgraduate training in paediatric surgery (see Chapter IV)

1. Most of the surgical care of children up to the age of 12 years in Britain is provided by surgeons who are chiefly engaged in the treatment of adults and only a small proportion of the total operative work is undertaken by surgeons who confine their work to the treatment of children. Where centres of paediatric surgery have been established, they undertake the general surgical work of children in their immediate vicinity but also provide a service which deals with almost all of the neonatal surgical problems over a much wider area. The distribution of these centres in Britain and their staffing is discussed below.

Consultants

2. The 25 surgeons in England, Wales and Scotland who confine their work to the care of children are distributed as follows:

Scotland	Glasgow	6
	Edinburgh	4
England and Wales	Newcastle	1
	Sheffield	2
	Liverpool	3
	Manchester	2
	London	7

3. While most are general surgeons, some have more specialised interests for example in cardiothoracic or urological work.

4. In other areas, some general surgeons have been designated, or by custom have undertaken, to accept particular responsibility for paediatric surgery. In the case of Dundee and Aberdeen and also the non-university Northern Region centred on Inverness the regional population is too small to justify the establishment of a highly specialised surgical centre and team.

Senior registrars

5. There is an establishment for only 4 senior registrars in the specialty in England, Wales and Scotland; 3 at the Hospital for Sick Children, Great Ormond Street, London, and 1 at Alder Hey Hospital, Liverpool. The former senior registrar posts in Edinburgh and Glasgow have lapsed.

6. During the last 20 years the number of young surgeons from England, Wales and Scotland who have pursued an interest in paediatric surgery has been restricted by the scarcity of consultant appointments in the specialty. During the last 10 years 17 men and 2 women have been senior surgical registrars at Great Ormond Street (11 from the United Kingdom, 1 from Eire, 3 from Australia, 1 from New Zealand, 1 from South Africa, 1 from the U.S.A., and 1 from India). Of these, 3 (all from the United Kingdom) remain in post, 10 are consultant paediatric surgeons (5 in the United Kingdom, 1 in Eire, 3 in Australia, and 1 in the U.S.A.), 4 are consultant general surgeons (but three of these

would have preferred to remain in paediatric surgery), 1 is in general practice and the fate of the last is uncertain. With the exceptions of 1 from South Africa and 1 from New Zealand who have achieved consultant status here, the others from overseas have returned to their own countries.

Registrars

7. There are posts for surgical registrars in nearly all the regional children's hospitals but they often vary, both in standing, according to their relationship with registrar rotation schemes of the associated medical schools where these exist, and in numbers, according to the advisability at a particular time of making an appointment and sometimes because of the lack of suitable candidates.

Requirements for training and staffing

8. The steady tendency towards whole-time academic clinical units attached to university departments suggests that the most suitable place for training paediatric surgeons is in the main regional centre. The pattern of training should be that proposed by the British Association of Paediatric Surgeons and accepted by the Royal Colleges of Surgeons. Some experience at either the senior house surgeon or registrar level is most desirable since it is at these stages that the inclination to adopt a specialty is best developed and that some judgement of the calibre of the individual can be made. Emphasis has been rightly laid on the importance of a broadly based training in surgery in general, before anyone concentrates on any specialty. This is particularly important in the case of the paediatric surgeon who must be more a specialist in an age group than in a region or system.

9. Outside London there should be at the main centre of each large region a specialist children's hospital to which will be transferred the more difficult and complicated clinical problems requiring special facilities of various kinds. In addition this centre will provide a routine service for the immediate neighbourhood, will contain the university paediatric departments and will be staffed largely if not entirely by specialist paediatric surgeons and paediatricians. The bulk of the less specialised paediatric surgery of the region will remain the responsibility of the general surgeons in the more peripheral parts of the region. For such a regional scheme some of the general surgeons should have had some experience of general paediatric surgery during their time as registrars and to provide this in the central children's hospital an adequate amount of less specialised general paediatric surgery should be done there.

10. It has been estimated that the number of specialist paediatric surgeons (25) at present working in Britain should be doubled if an adequate service is to be established throughout the country. This figure implies an establishment of one paediatric surgeon for approximately each million of population, an estimate which is in line with the services provided and proposed per million population in Liverpool and in Sheffield. The relationship between establishment of consultant posts and population should be based on the wider area from which more specialised surgical work and in particular neonatal surgery is attracted, rather than on the more limited area from which less difficult and less complex surgical problems of childhood are admitted.

11. The Liverpool unit with its three consultants and plans for a fourth (about half-time clinical and half-time academic) serves a population of about three millions. Sheffield has two consultants (and now requires a third) to provide adequate cover for approximately three and a half million of population served by this centre for the more difficult paediatric surgical problems, especially for neonatal surgery.

12. It is not unreasonable to accept the staffing/population ratio of these two centres as an indication of approximate requirement to provide paediatric surgical and especially neonatal surgical cover in other regions. Although this works out at about one surgeon per million of population, there are clearly great advantages in concentrating this specialist service in teams of two or three surgeons in larger centres.

13. It is also more important to ensure that every large hospital region should have at its central children's hospital a complete service for dealing with the surgical emergencies of the newborn than to try to estimate the exact number of various types of emergency which may need treatment, because such estimates cannot yet be very accurate. This service should include not only two consultant paediatric surgeons but will also require two consultant paediatric anaesthetists. In the busier centres serving the larger regional populations there will also be a senior registrar but in each centre there should be two registrars and at least two house surgeons.

14. This necessary expansion of consultant posts in paediatric surgery requires an immediate increase in senior registrar posts in the established centres where training can be undertaken. Such senior registrar posts could well temporarily replace some registrar posts until it is clear that the supply of well trained consultants is catered for.

15. In addition the teaching for undergraduates and postgraduates in the particular surgical problems of children and especially of the newborn will require additional senior staff with close university affiliation and facilities for research. The possibility of establishing two or three more full time chairs or university lectureships in paediatric surgery has already been alluded to.

16. In London there are already well equipped and efficient neonatal surgical services in three children's hospitals and facilities for post-operative care in a fourth hospital and there seems to be little need for the development of any further units of this kind; rather the patients should be concentrated in these units and if necessary their capacity should be increased.

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